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Suppliers' Information Note

For The Openreach Network

Optical Spectrum Access™

Service & Interface Description

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1. Introduction

This Suppliers' Information Note (SIN) describes the Openreach Optical Spectrum Access (OSA) service, and its interfaces. Optical Spectrum Access (OSA) is an Openreach product within the Optical Spectrum Services portfolio.

This SIN covers the OSA service using the current ADVA FSP3000 and XG210 equipment, including OSA FSP3000 Filter Connect and OSA XG210 Filter Connect services that allows customers to directly connect to the OSA optical filters for the passing of their own traffic over the same fibre using dedicated wavelengths.

This document should be read in conjunction with the OSA Product Description available on the Openreach portal

https://www.openreach.co.uk/orpg/home/products/opticalservices/opticalservices.do

Please note that

1) from 1 June 2022, OSA FSP3000 Resilience Option 1 is not available for new orders. All other OSA FSP3000 (including Filter Connect) products and OSA XG210 Filter Connect products are unaffected by this stop sell. Openreach briefing ETH014/22 refers.

2) from 1 June 2023, the 2WCC-PCN-10G, 2TWCC-PCN-2G7UB, 2WCA-PCN-10G and 5TCE-PCN-10GU+10G wavelength cards are not available for new orders. Openreach briefing ETH009/23 refers.

3) from 1 February 2024, the OSA XG210 8x1GE wavelength card, with optical client interfaces (GE-8S-CC), OSA XG210 8x1GE wavelength card, with electrical client interfaces (GE-8E-CC), OSA XG210 Additional 1U Chassis and OSA XG210 Pre-amplifier are not available for new orders. Openreach briefing ETH034/23 refers.

4) from 1 April 2025, all OSA FSP3000 non-Filter Connect bearer options are withdrawn from new supply. Openreach briefing ETH031/24 refers.

2. General Service Outline for OSA services

2.1. NTE vendor

The Network Terminating Equipment (NTE) types currently used for Optical Spectrum Access service 1U and 7U bearers, is the ADVA FSP3000 platform. The NTE type used for Optical Spectrum Access service XG210 bearers is the ADVA XG210 platform. However, optical filters used on ADVA XG210 bearers are from the FSP3000 platform, as are amplification components such as amplifier cards, dispersion compensation modules and chassis.

ADVA offers a choice of service interface cards. Please refer to section 7 and section 8 for further information.

http://www.openreach.co.uk/orpg/home/products/opticalservices/opticalservices.do

2.2. Service Outline for OSA FSP3000 services (including Filter Connect)

The maximum number of wavelengths supported by the OSA FSP3000 service is 36. This drops to 31 in the case of Resilience Option 1 ** protected bearers (Optical Multiplex Section Protection) as this requires Channel 32 for the Optical Supervisory Channel (OSC).

OSA supports Point-to-Point, Hub & Spoke and Aggregated Hub & Spoke service. OSA FSP3000 Filter Connect supports Point-to-Point services only.

Depending on the distance requirement and the transponder card types selected the bearer will be deployed without amplification (passive) for short reach distances; preamplifier cards for intermediate reach distances; and preamplifier and booster amplifier cards for the longest distances.

** *RO1 unavailable for new supply after 1 June 2022*

2.3. Service Outline for OSA XG210 Filter Connect services

OSA XG210 Filter Connect supports a maximum of two wavelengths. Resilience Option 1 is not available. OSA XG210 Filter Connect supports Point-to-Point services only.

Depending on the distance requirement and the transponder card types selected, the bearer will be deployed without amplification (passive) for short reach distances, or with amplification for longer reach distances.

3. Bearer types offered on Optical Spectrum Access FSP3000

Customers can order the following OSA bearer type options:

3.1. 1U Single bearer

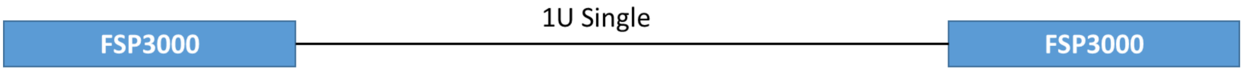

Figure 1: FSP3000 1U Single bearer

For this configuration, the term “single” is used to indicate that 1U high FSP3000 shelves are deployed without DWDM filters and will only support a single channel. In this configuration Filter Connect is not applicable.

Customers can choose either an AC or DC powered 1U chassis for either end of a link.

Please note that some FSP3000 wavelength cards require a ‘high power’ FSP3000 1U or 9U chassis. The FSP3000 1U/9U High Power AC-powered chassis can be subtended off an existing FSP3000 active shelf (any type). The 1U E-temp chassis, introduced in early 2025, can support wavelength cards with higher power requirements. Please refer to Section 8 Customer Interface – FSP3000.

Card and channel growth

Channel growth beyond a single wavelength will require the 1U single bearer type to be converted to a 1U standard type via a modify order to support up to 8 wavelengths. Similarly, channel growth beyond 8 wavelengths will require conversion to a 7U standard bearer via a modify order. Please note any upgrades from 1U single to 1U Standard or 7U Standard or resilience service will be service effecting upgrade.

1U single bearer deployments will be limited to fibre route distances that will allow upgrade to 1U standard supporting growth to 8 wavelengths and 7U standard bearers supporting growth to 31/32 wavelengths. Any changes in the bearer type including the addition of an 8GSM filter to a bearer will require downtime.

Protection Options

RO1 protection is not supported on this bearer option, though RO2 is supported via an RO2 variant of the 1U single bearer (OSA 1U Single RO2). RO1 resilience ** will require an upgrade to the 7U RO1 bearer option, though confirmation that it will be possible to upgrade to RO1, will be subject to survey based on planning rules based on the bearer fibre route distance and transponder card types used on the bearer.

** *RO1 unavailable for new supply after 1 June 2022*

3.2. 1U standard bearer with 8CSM option

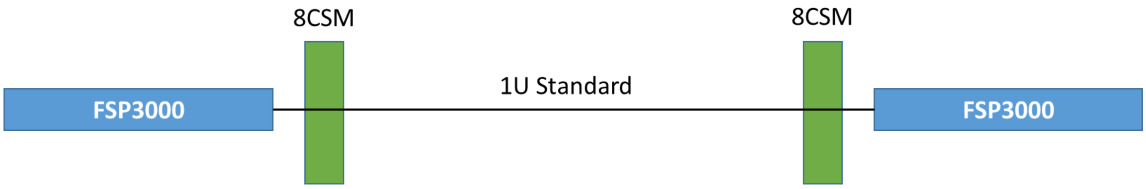

Figure 2: FSP3000 1U Standard bearer

A single 8-channel filter (8CSM) is fitted to this bearer; therefore, this service will support (non-traffic affecting) channel growth to 8 wavelengths. If required, a 4-channel filter (4CSM) can be selected instead to preserve space in the chassis.

Customers can choose either an AC or DC powered 1U or 7U chassis (7U chassis only valid for subsequent chassis) for either end of a bearer link. The mixing of AC and DC on a single chassis at the same location is not permitted.

Please note that some FSP3000 wavelengths cards require a 'high power' FSP3000 1U or 9U chassis. The FSP3000 1U/9U High Power AC-powered chassis can be subtended off an existing FSP3000 active shelf (any type). The 1U E-temp chassis, introduced in early 2025, can support wavelength cards with higher power requirements. Please refer to Section 8 Customer Interface – FSP3000.

Card and channel growth

Channel growth beyond 8 wavelengths will require the 1U standard bearer to be upgraded to a 7U standard bearer via a modify order. The 8-channel Group Splitter Module (8GSM) filter card must also be ordered at this time. Any 8CSM filters would need to be replaced with 4CSM filters to connect to the 8GSM. This bearer upgrade is traffic affecting, therefore any customer expecting growth beyond 8 wavelengths is encouraged to choose the 7U bearer option with 8GSM band filter card fitted initially to allow non-traffic affecting growth.

It will be possible to include pre-amplifier and / or booster amplifier cards during the necessary downtime to compensate for the additional optical loss introduced by the 8GSM filter card or optical loss introduced by the VSM protection module if converting to 7U RO1 bearer.

If a 7U chassis is ordered as a 'subsequent' chassis, this bearer type will still be classed as a 1U standard bearer, with growth limit of 8 wavelengths. Growth beyond 8 wavelengths will require a Modify order to convert the "1U standard" bearer to a 7U standard bearer, with an additional order to add the 8-band filter card and any additional amplifier cards. Upgrade to 7U standard bearer will, in most cases, be carried out using a Provide and Cease of the chassis with 1U high chassis expected to be recovered. This upgrade will require downtime but will allow RO1 capability (subject to distance limits not being exceeded) and will minimize space requirements for bearers containing a moderate number of wavelengths.

Protection Options

RO1 is not supported on 1U bearers, even if the 1U bearer type contains a (subsequent) 7U high chassis. RO2 resilience is supported as a 1U RO2 bearer option.

RO1 resilience ** will require an upgrade to the 7U RO1 bearer option. Whilst all bearers will be able to upgrade to support 31/32 wavelengths, confirmation that it will be possible to upgrade to RO1 will be subject to survey using planning rules based on fibre route distance and transponder card types used on the bearer.

** *RO1 unavailable for new supply after 1 June 2022.*

3.3. 7U standard or 7U RO1 bearer

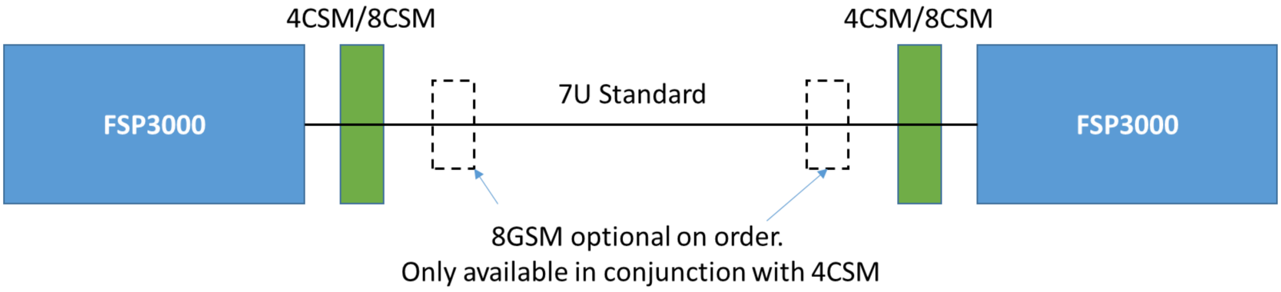

Figure 3: FSP3000 7U Standard/RO1 bearer

At order stage, customers may opt to have the 8-band filter module (8GSM) pre-deployed for 7U standard, 7U RO2 and 7U R01 bearer options. Where the 8GSM filter card is not pre-deployed, only a maximum number of 8 channels can be supported. A capacity increase beyond 8 wavelengths will require downtime to fit an 8GSM filter module and swap existing 8CSM filters to 4CSM filters. Where the 8GSM filter module is fitted channel growth to 32 wavelengths can be supported without the need for downtime. Only 31 channels are supported in case of RO1 bearers.

Customers can choose either an AC or DC powered 7U chassis for either end of a bearer link. The mixing of AC and DC on a single chassis at the same location is not permitted.

Please note that some FSP3000 wavelengths cards require a 'high power' FSP3000 1U or 9U chassis. The FSP3000 1U/9U High Power AC-powered chassis can be subtended off an existing FSP3000 active shelf (any type). The 1U E-temp chassis, introduced in early 2025, can support wavelength cards with higher power requirements. Please refer to Section 8 Customer Interface – FSP3000.

Card and channel growth

Channel growth beyond 8 wavelengths will require the 7U standard bearer to contain an 8GSM filter card. This bearer upgrade is traffic affecting, and in some cases will require additional amplifier cards to be added to compensate for additional loss introduced by the 8GSM filter card, particularly on longer links. Any customer expecting growth beyond 8 wavelengths should be encouraged to choose the 7U bearer option with 8GSM card fitted on initial order.

7U standard bearers may only be deployed over fibre route distances that will allow upgrade to 31/32 wavelengths. It will be possible to include pre-amplifier and / or booster amplifier cards during the necessary downtime to compensate for the additional optical loss introduced by the 8GSM filter card or optical loss introduced by the VSM protection module if converting to 7U RO1 bearer **.

** *RO1 unavailable for new supply after 1 June 2022*

3.4. 1U standard bearer with 8CSM+ option

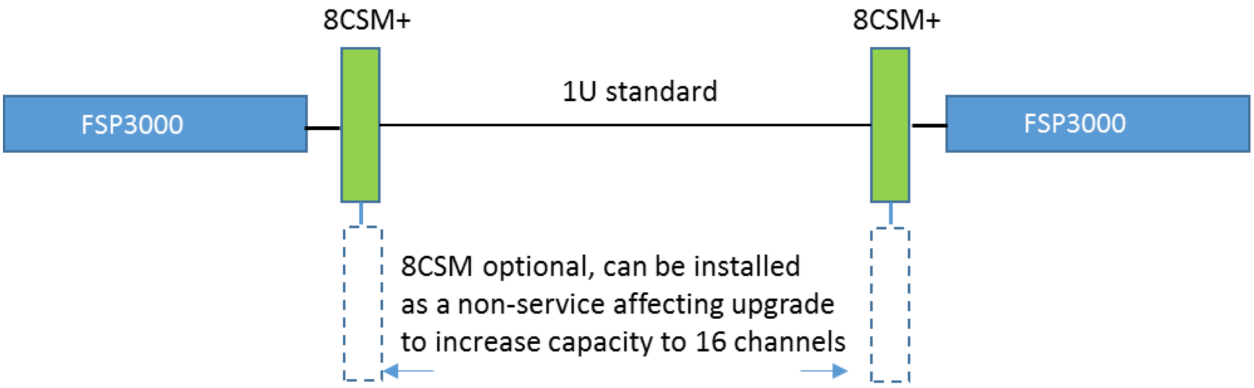
8CSM+
8CSM+
1U standard
FSP3000
FSP3000
8CSM optional, can be installed
as a non-service affecting upgrade
to increase capacity to 16 channels

Figure 4: FSP3000 1U Standard with 8CSM+ filter

A single 8-channel filter (8CSM+) containing an upgrade port is fitted to this bearer. Therefore, this service will support non-traffic affecting channel growth to 16 channels with the addition of an 8CSM filter.

This bearer type will allow customers to access the OSA FSP3000 bearer, via spare ports on the 8CSM/8CSM+ cards, with their own equipment. In this usage case the customer interfaces and service demarcation point is on the filter ports. These are dual LC.

Customers can choose either an AC or DC powered 1U or 7U chassis (7U chassis only valid for subsequent chassis) for either end of a bearer link. The mixing of AC and DC on a single chassis at the same location is not permitted.

Please note that some FSP3000 wavelengths cards require a 'high power' FSP3000 1U or 9U chassis. The FSP3000 1U/9U High Power AC-powered chassis can be subtended off an existing FSP3000 active shelf (any type). The 1U E-temp chassis, introduced in early 2025, can support wavelength cards with higher power requirements. Please refer to Section 8 Customer Interface – FSP3000.

Upgrade to 7U standard bearer is supported and will, in most cases, be carried out using a Provide and Cease of the chassis. The redundant 1U high chassis will be recovered. This upgrade will require downtime but will allow RO1 capability (subject to distance limits not being exceeded) and will minimize space requirements for bearers containing a moderate number of wavelengths.

Protection Options

RO1 is not supported on 1U bearers, even if the 1U bearer type contains a subsequent 7U high chassis. RO2 resilience is supported as a 1U RO2 bearer option.

RO1 resilience ** will require an upgrade to the 7U RO1 bearer option. Confirmation that it will be possible to upgrade to RO1 will be subject to survey using planning rules based on fibre route distance and transponder card types used on the bearer.

*** RO1 unavailable for new supply after 1 June 2022*

3.5. 7U standard or 7U RO1 bearer with 8CSM+ option

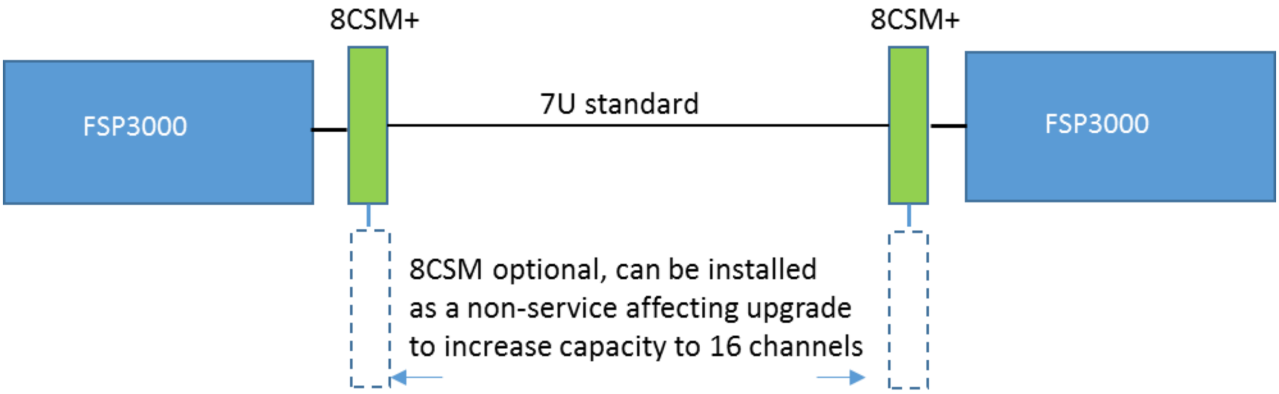
8CSM+
8CSM+
FSP3000
7U standard
FSP3000
8CSM optional, can be installed as a non-service affecting upgrade to increase capacity to 16 channels

Figure 5: FSP3000 7U Standard/RO1 with 8CSM+ filter

A single 8-channel filter (8CSM+) containing an upgrade port is fitted to this bearer. Therefore, this service will support non-traffic affecting channel growth to 16 channels with the addition of an 8CSM filter.

This bearer type will allow customers to access the OSA bearer, via spare ports on the

8CSM/8CSM+ cards, with their own equipment. In this usage case, the customer interfaces and service demarcation point, is on the filter ports. These are dual LC.

Customers can choose either an AC or DC powered 7U chassis for either end of a bearer link. The mixing of AC and DC on a single chassis at the same location is not permitted.

Please note that some FSP3000 wavelengths cards require a 'high power' FSP3000 1U or 9U chassis. The FSP3000 1U/9U High Power AC-powered chassis can be subtended off an existing FSP3000 active shelf (any type). The 1U E-temp chassis, introduced in early 2025, can support wavelength cards with higher power requirements. Please refer to Section 8 Customer Interface – FSP3000.

RO1 resilience ** will require an upgrade to the 7U RO1 bearer option. Confirmation that it will be possible to upgrade to RO1 will be subject to survey using planning rules based on fibre route distance and transponder card types used on the bearer.

** *RO1 unavailable for new supply after 1 June 2022.*

4. Bearer types offered on Optical Spectrum Access XG210

Customers can order the following OSA FC XG210 bearer type options:

4.1. OSA XG210 DFW (Dual Fibre Working) 8/16 channel standard or RO2 bearer

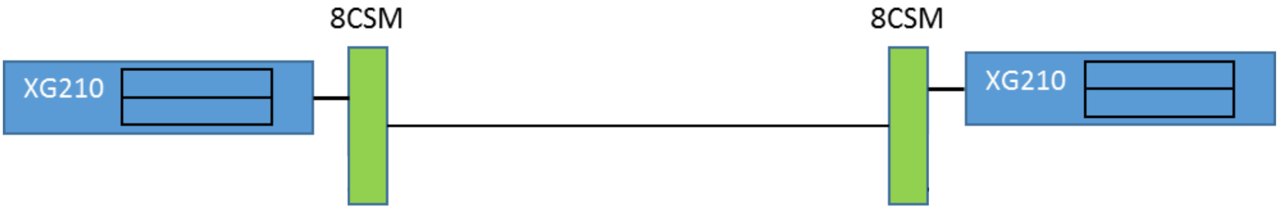

Figure 6: XG210 (DFW) 8channel bearer with 8CSM filter

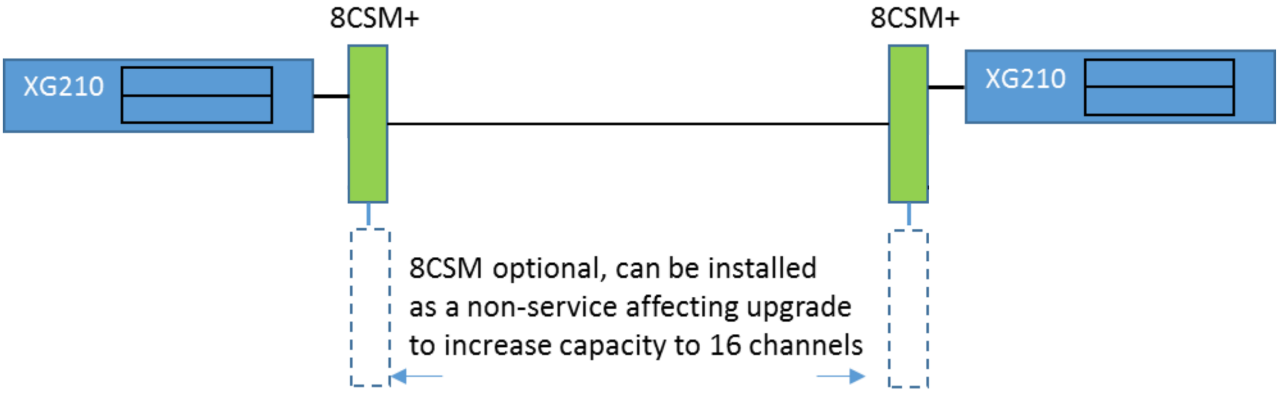
8CSM+
8CSM+
XG210
XG210
8CSM optional, can be installed as a non-service affecting upgrade to increase capacity to 16 channels

Figure 7: XG210 (DFW) with 8CSM+ filter and upgrade capability to 16 channels

The main features of this bearer type are the use of the XG210 NTE that includes support of extended temperature operation, transport of phase and synchronisation and optional VLAN aggregated interfaces. An 8-channel filter (8CSM or 8CSM+) is fitted to this bearer.

This filter contains an upgrade port that will allow an 8CSM card to be added, thereby increasing the maximum number of channels supported to 16. This upgrade in capacity is expected to be non-traffic affecting.

The XG210 bearer types will allow customers to access the OSA XG210 bearer, via spare ports on the 8CSM/8CSM+ card, with their own equipment. In this usage case, the customer interfaces and service demarcation point, is on the filter ports. These are dual LC.

Customers can choose either an AC or DC powered NTE. The mixing of AC and DC on a single chassis at the same location is not permitted.

Each NTE can support two service cards, each capable of transporting 10Gbit/s of traffic (10G port card) on an individual wavelength. Amplification is available on this bearer type to increase range; however, this must be located in temperature-controlled locations. Where one end of a link is not in a temperature-controlled location, single-ended amplification is offered.

This bearer type does not offer RO1 protection.

4.2. OSA XG210 SFW (Single Fibre Working) 8/16/24 channel standard or RO2 bearer

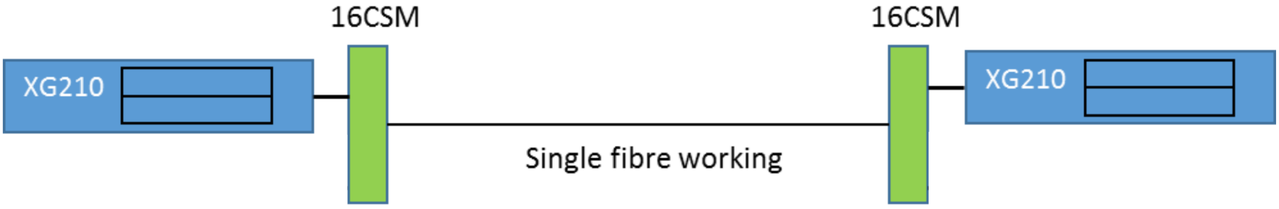

Figure 8: XG210 (SFW) with 16CSM filter

The main features of this bearer type is the use of the XG210 NTE that includes support of extended temperature operation, transport of phase and synchronisation, and optional VLAN aggregated interfaces. A single fibre working 8-channel (8CSM), 16-channel (16CSM) or 24-channel (24CSM) optical filter can be fitted to this bearer.

The XG210 bearer types will allow customers to access the OSA bearer, via spare ports on the optical filter card, with their own equipment. In this usage case, the customer interfaces and service demarcation point, is on the filter ports. These are dual LC.

Customers can choose either an AC or DC powered NTE. The mixing of AC and DC on a single chassis at the same location is not permitted.

Each NTE can support two service cards capable of transporting 10Gbit/s of traffic (10G port card) on an individual wavelength. Amplification is available on this bearer type in conjunction with the 16-channel filter to increase range, however this must be in temperature-controlled locations. Where one end of a link is not in a temperature-controlled location, single-ended amplification is offered. Amplification is not available for single-fibre working systems with the 8-channel or 24-channel optical filters.

This bearer type does not offer RO1 protection.

5. Services supported on the OSA FSP3000

The service allows the point-to-point transport of the following services between customer sites:

- 100Gbit/s Ethernet
- G.709 OTU4 (111.8Gbit/s)
- STM-64 (9.9532 Gbit/s)
- STM-16 (2.488 Gbit/s)
- STM-4 (622 Mbit/s)
- STM-1 (155 Mbit/s)*
- Gigabit Ethernet (1.25 Gbit/s)
- 10Gbit/s Ethernet LAN PHY (10.3125 Gbit/s)
- 10Gbit/s Ethernet WAN PHY (9.9532 Gbit/s)
- Fibre Channel / FICON 1Gbit/s FC100 (1.062 Gbit/s) **
- Fibre Channel/FICON 2Gbit/s FC200 (2.125 Gbit/s)
- Fibre Channel/FICON 4Gbit/s FC400 (4.25Gbit/s)
- Fibre Channel/FICON 8Gbit/s FC800 (8.50Gbit/s)
- Fibre Channel/FICON 10Gbit/s FC1200 (10.52Gbit/s)
- G.709 OTU2 (10.709 Gbit/s)
- G.709 OTU1 (2.666 Gbit/s)
- ISC-3 Peer Mode (2.125Gbit/s) **

Optical Spectrum Access services are intended for connection to standard optical interfaces of 850nm multimode or 1310nm single-mode / multimode types. No electrical interfaces are offered. Table 2 gives details of the optical interface / service options for FSP3000.

* Unavailable for new supply after 5 July 2021

** Unavailable for new supply after 1 June 2023

6. Circuit protection

This service is offered on a point-to-point basis with optionally no fibre circuit protection (Standard), or with Resilience Option 1** or Resilience Option 2 protection options.

	Standard	Resilience Option 1 **	Resilience Option 2
OSA FSP3000 1U Single	Y	N	Y
OSA FSP3000 1U Standard	Y	N	Y
OSA FSP3000 7U Single	Y	Y	Y
OSA FSP3000 7U Standard	Y	Y	Y
OSA FSP3000 Filter Connect 1U Standard	Y	N	Y
OSA FSP3000 Filter Connect 7U Single	Y	Y	Y
OSA FSP3000 Filter Connect 7U Standard	Y	Y	Y
OSA XG210 Filter Connect	Y	N	Y

Table 1: Resilience options

Standard consists of a single OSA Bearer between the circuit A-end and B-end addresses with no standby circuit or path. In the event of a fibre failure service may be lost. It is recommended that a back-up service is available.

Resilience Option 1 (RO1) ** consists of a single OSA Bearer between the same circuit A-end and B-end addresses with two diversely routed fibre paths. In the event of a problem occurring on the primary route, traffic will be automatically switched to the secondary fibre path. The protection is performed on the fibre link carrying the multiplexed wavelengths. Protection is not provided on a per optical channel basis. The protection switching will include any Filter Connect wavelengths.

** *RO1 unavailable for new supply after 1 June 2022.*

Resilience Option 2 (RO2) consists of two individual OSA Bearers delivered using diversely routed fibres between the same circuit A-end and B-end addresses, or between the same A-end and different B-end addresses. Customers are free to use each bearer as they wish. It is the customers' responsibility to ensure that the traffic carrying capacity of the wavelengths is sufficient to support the resilience of their service in the event of failure. Note that the two OSA bearers in an RO2 configuration do not perform an automatic protection switching. If protection switching is required, this will need to be supplied by the CP.

The maximum permitted fibre route distance will vary depending on the vendor, wavelength speed and resilience option used. Refer to the OSA Product Handbook for further information on bearer resilience options and distance limitations:

http://www.openreach.co.uk/orpg/home/products/opticalservices/opticalservices.do

Protocols with latency sensitivities may require customer reconfiguration following an incident resulting in a switch to the protection path. The Openreach equipment will continue to function on the protection path.

7. Customer Interface – FSP3000

The patch panel interface, where used, is the Network Termination Point (NTP), i.e. the point of connection between the Openreach Network Terminating Equipment (NTE) and the CPE interface.

Customer interfaces for managed services are presented via an optical patch panel using **dual LC** interfaces or directly on the NTE wavelength card where different connection types may be used depending on the service selected. Either a single duplex or a pair of simplex LC cables may be used where appropriate, though duplex cables with dual LC connectors will ensure that transmit and receive connections are correctly made the right way round.

Filter Connect is an enhancement to the OSA FSP3000 product that enables customers to access the OSA bearer, via spare ports on the optical filter, with their own equipment. In this usage case, the customer interfaces and service demarcation point, is on the filter ports. These are **dual LC**. Direct customer connection to an 8GSM filter card, where fitted, is not permitted.

Single-mode (1310nm) or multimode (850nm) interface options are available depending on the type of wavelength card selected. The NTE vendor offers a choice of wavelength interface cards, however there may be differences in the number and types of interfaces supported per card. Additionally, customers can connect directly to ports on the optical filter where an OSA service has been certified for Filter Connect usage. This will be the service boundary in this instance for own connected cabling.

Please note:

1) The 5TCE-PCTN-10GU+10G, 5TCE-PCTN-10GU+AES10G, 10TCC-PCTN-4GUS+10G, WCC-PCTN-10G, WCC-PC1N-2G7U, 4TCA-PCN-4GU+4G, 4TCA-PCN-4GUS+4G , 5TCE-PCN-10GU-AES10G, 2WCC-PCN-10G, 2TWCC-PCN-2G7UB, 5TCE-PCN-10GU+10G and 2WCA-PCN-10G cards are no longer available for new supply.
2) Due to higher power requirements, the **10TCE-PCN-16G+100G** (10x 10G Enterprise Card) and **WCC-PCN-100GB** (100G Channel Card Core Type**)** can only be installed in an FSP3000 1U High Power chassis, 1U E-temp or FSP3000 9U chassis. These cards occupy two service slots in the chassis. These cards cannot be installed in any 7U chassis.
3) Due to higher power requirements, the **4WCC-PCN-10G (**4x 10G Core Card) can only be installed in an FSP3000 1U High Power chassis, 1U E-temp or FSP3000 9U chassis. This card occupies a single slot in the chassis. This card can be installed in any 7U chassis if a slot is left free on either side of this single width card to allow sufficient cooling in a 7U chassis, therefore each **4WCC-PCN-10G** will require 3 (consecutive) slots to be available in any 7U chassis.

Service	**Card type**	**Transparency**	**Client Port Options** Pluggable type / maximum speed / wavelength /Single-Mode(SM) or Multimode (MM) / connector type	**Client port Error signal**
100GE	WCC-PCN-100GB	PCS layer	QSFP28/112G/LR4/SM/LC QSFP28/112G/SR4/MM/MPO	Loss of Signal
OTU4	WCC-PCN-100GB	ODU4 transparent	QSFP28/112G/LR4/SM/LC	Loss of Signal
10G Fibre Channel	5TCE-PCN-10GU+10G *	PCS layer	SFP+/10G/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
	10TCE-PCN-16GU+100G	PCS layer	SFP+CDR/11GU/1310S/SM/LC	Loss of Signal
	2WCA-PCN-10G *	Physical layer	XFP/11G/1310S/SM/LC or XFP/10G/850I/MM/LC	Loss of Signal
	5TCE-PCN-10GU+AES10G *	PCS layer	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
10G LAN PHY	WCC-PCTN-10G *	PCS Layer	XFP/11G/1310S/SM/LC	Local Fault as per IEEE802.3
	9TCE-PCN-10GU+10G	PCS Layer	SFP+/11GU/850I/MM/LC SFP+/11GU/1310S/SM/LC	Loss of Signal (Laser off) or EPC (error propagation code)
	2WCC-PCN-10G *	PCS Layer	XFP/11G/1310S/SM/LC or XFP/10G/850I/MM/LC	Local Fault as per IEEE802.3
	4WCC-PCN-10G	PCS Layer	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Local Fault as per IEEE802.3
	5TCE-PCN-10GU+10G *	PCS layer	SFP+/10G/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
	10TCE-PCN-16GU+100G	PCS layer	SFP+CDR/11GU/1310S/SM/LC or SFP+CDR/10GU/850I/MM/LC	Loss of Signal
	2WCA-PCN-10G*	Physical layer	XFP/11G/1310S/SM/LC or XFP/10G/850I/MM/LC	Loss of Signal
	5WCA-PCN-16GU	Physical layer	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
	5TCE-PCN-10GU+AES10G *	PCS layer	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
10G WAN PHY / STM-64	WCC-PCTN-10G *	client signal not modified	XFP/11G/1310S/SM/LC	MS-AIS (ITU-T G.783)

	9TCE-PCN-10GU+10G	PCS Layer	SFP+/11GU/850I/MM/LC SFP+/11GU/1310S/SM/LC	Loss of Signal (Laser off)
	10TCE-PCN-16GU+100G	client signal not modified	SFP+CDR/11GU/1310S/SM/LC	Loss of Signal
	2WCC-PCN-10G *	client signal not modified	XFP/11G/1310S/SM/LC	MS-AIS (ITU-T G.783)
	4WCC-PCN-10G	client signal not modified	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	MS-AIS (ITU-T G.783)
	2WCA-PCN-10G *	Physical Layer	XFP/11G/1310S/SM/LC	Loss of Signal
OTU2	WCC-PCTN-10G *	ODU transparent	XFP/11G/1310S/SM/LC	AIS-ODU
	9TCE-PCN-10GU+10G	OPU2 transparent	SFP+/11GU/850I/MM/LC SFP+/11GU/1310S/SM/LC	Loss of Signal (Laser off) or AIS (Alarm Identification Signal)
	2WCC-PCN-10G *	ODU2 transparent (OTU GCC0 reserved for Openreach use)	XFP/11G/1310S/SM/LC	AIS-ODU
	4WCC-PCN-10G	ODU2 transparent	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	AIS-ODU
	2WCA-PCN-10G *	Fully transparent	XFP/11G/1310S/SM/LC	Loss of Signal (Laser off)
8G Fibre Channel	5TCE-PCN-10GU+10G *	PCS Layer	SFP+/10G/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
	9TCE-PCN-10GU+10G	PCS Layer	SFP+/11GU/850I/MM/LC SFP+/11GU/1310S/SM/LC	Loss of Signal (Laser off) or EPC (error propagation code)
	10TCE-PCN-16GU+100G	PCS layer	SFP+CDR/11GU/1310S/SM/LC or SFP+CDR/10GU/850I/MM/LC	Loss of Signal
	2WCC-PCN-10G *	PCS layer	XFP/8G/1310S/SM/LC	Non-valid line code as per ITU-T G.7041
	2WCA-PCN-10G *	Physical layer	XFP/8G/1310S/SM/LC	Loss of Signal
	5WCA-PCN-16GU	Physical layer	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
	5TCE-PCN-10GU+AES10G *	PCS layer	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
4G Fibre Channel	4TCA-PCN-4GU+4G *	PCS layer	SFP/4GU/850I/MM/LC or SFP/4GU/1310S/SM/LC	Loss of Signal

	9TCE-PCN-10GU+10G	client signal not modified	SFP/4GU/850I/MM/LC SFP/4GU/1310S/SM/LC	Loss of Signal (Laser off) or EPC (error propagation code)
	5TCE-PCN-10GU+10G *	PCS Layer	SFP/4GU/850I/MM/LC or SFP/4GU/1310S/SM/LC	Loss of Signal
	10TCC-PCTN-4GUS+10G *	PCS layer	SFP/4GU/850I/MM/LC or SFP/4GU/1310S/SM/LC	Non-valid line code as per ITU-T G.7041
	2WCA-PCN-10G *	Physical layer	XFP/8G/1310S/SM/LC	Loss of Signal
	5TCE-PCN-10GU+AES10G	PCS Layer	SFP/4GU/850I/MM/LC or SFP/4GU/1310S/SM/LC	Loss of Signal
2G Fibre Channel	4TCA-PCN-4GU+4G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Non-valid line code as per ITU-T G.7041
	9TCE-PCN-10GU+10G	client signal not modified	SFP/4GU/850I/MM/LC SFP/4GU/1310S/SM/LC	Loss of Signal (Laser off) or EPC (error propagation code)
	5TCE-PCN-10GU+10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
	10TCC-PCTN-4GUS+10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Non-valid line code as per ITU-T G.7041
	2TWCC-PCN-2G7U *	Physical layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
	5TCE-PCN-10GU+AES10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
1G Fibre Channel	4TCA-PCN-4GU+4G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Non-valid line code as per ITU-T G.7041
	5TCE-PCN-10GU+10G *	PCS Layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
	10TCC-PCTN-4GUS+10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Non-valid line code as per ITU-T G.7041
	5TCE-PCN-10GU+AES10G *	PCS Layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
	2TWCC-PCN-2G7U*	Physical layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
Gigabit Ethernet	4TCA-PCN-4GU+4G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	K30.7 (8B/10B code word) as per ITU-T G.7041 and IEEE802.3
	9TCE-PCN-10GU+10G	client signal not modified	SFP/2G1/850I/MM/LC SFP/2G5U/1310S/SM/LC	Loss of Signal (Laser off) or EPC (error propagation code)

	4TCA-PCN-4GUS+4G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	K30.7 (8B/10B code word) as per ITU-T G.7041 and IEEE802.3
	5TCE-PCN-10GU+10G *	PCS Layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
	5TCE-PCN-10GU+AES10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
	10TCC-PCTN-4GUS+10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Default setting: K30.7 (8B/10B code word) as per ITU-T G.7041 and IEEE802.3. Alternatively, Loss of Signal can be requested on CRF
	2TWCC-PCN-2G7U *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	K30.7 (8B/10B code word) as per ITU-T G.7041 and IEEE802.3
STM-4	4TCA-PCN-4GUS+4G *	client signal not modified	SFP/2G5U/1310S/SM/LC	Loss of Signal
	9TCE-PCN-10GU+10G	PCS layer	SFP/2G5U/1310S/SM/LC	Loss of Signal (Laser off)
	WCC-PC1N-2G7U *	client signal not modified	SFP/2G5U/1310S/SM/LC	MS-AIS
	10TCC-PCTN-4GUS+10G *	client signal not modified	SFP/2G5U/1310S/SM/LC	Loss of Signal
STM-1	4TCA-PCN-4GUS+4G *	client signal not modified	SFP/2G5U/1310S/SM/LC	Loss of Signal
	WCC-PC1N-2G7U *	client signal not modified	SFP/2G5U/1310S/SM/LC	MS-AIS
	10TCC-PCTN-4GUS+10G *	client signal not modified	SFP/2G5U/1310S/SM/LC	Loss of Signal
STM-16	WCC-PC1N-2G7U *	client signal not modified	SFP/2G5U/1310S/SM/LC	MS-AIS
	9TCE-PCN-10GU+10G	PCS layer	SFP/2G5U/1310S/SM/LC	Loss of Signal (Laser off)
	10TCC-PCTN-4GUS+10G *	client signal not modified	SFP/2G5U/1310S/SM/LC	Loss of Signal
	2TWCC-PCN-2G7U *	client signal not modified	SFP/2G5U/1310S/SM/LC	MS-AIS

ISC-3 Peer Mode (2.125G)	5TCE-PCN-10GU+10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
	5TCE-PCN-10GU+AES10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
OTU1	WCC-PC1N-2G7U *	ODU1 transparent	SFP/2G5U/1310S/SM/LC	AIS-ODU
	2TWCC-PCN-2G7U *	ODU1 transparent	SFP/2G5U/1310S/SM/LC	AIS-ODU

Table 2: FSP3000 customer interface options

* Card unavailable for new supply

8. Customer Interface – XG210

Customer interfaces for managed services are presented via a dual LC interface directly on the NTE service card where different connection types may be used depending on the service selected. Either a single duplex or a pair of simplex LC cables may be used where appropriate, though duplex cables with dual LC connectors will ensure that transmit and receive connections are correctly made the right way round.

Each XG210 NTE contains 2 service slots, a service slot can take one of three cards:

1. **OSA XG210 10GE** Wavelength Card containing a single 10Gbit/s port client port bundled with either a single-mode or multimode SFP+ pluggable module. The customer traffic for this card is transmitted using a 10G LAN PHY Ethernet signal on a tuneable DWDM pluggable optic module. This card is also known as the **ADVA XG-1S-CC** or **F150-ADV-XG-PM-10GE-SFP+** card.
2. **OSA XG210 8x1GE** Wavelength Card containing 8 x 1Gbit/s client ports bundled with either 8 single-mode SFP or 8 multimode SFP pluggable modules. The customer traffic for this card is transmitted using a 10G LAN PHY Ethernet signal on a tuneable DWDM pluggable optic module. This card is also known as the **ADVA GE-8S-CC** or **F150-ADV-XG-PM-GE-8-SFP** card. *This card is not available for new supply.*
3. **OSA XG210 8x1GE** Wavelength Card containing 8 x 1Gbit/s built-in 1000BaseT electrical RJ45 ports. This card is also known as the **ADVA GE-8E-CC** or **F150-ADV-XG-PM-GE-8-RJ45** card. *This card is not available for new supply.*

Optical Spectrum Access services are intended for connection to standard optical interfaces of **850nm multimode** or **1310nm single-mode types**. Table 3 gives details of the optical interface / service options for the XG210.

The customer equipment Ethernet interface must conform to following IEEE 802.3 standard interfaces:

a. OSA XG210 10GE Wavelength Card containing a single 10Gbit/s port
   10GBASE-SR, [850 nm multimode 10G LAN PHY] or
   10GBASE-LR, [1310 nm single-mode 10G LAN PHY]

b. OSA XG210 8x1GE Wavelength Card containing 8 1G ports
   1000BASE-SX, [850 nm multimode Gigabit Ethernet] or
   1000BASE-LX, [1310 nm single-mode Gigabit Ethernet]

c. OSA XG210 8x1GE Wavelength Card containing 8 1G ports
   1000BASE-TX, [RJ45 electrical]

8.1. XG210 VLAN

For option 3 above, up to 8 individual 1Gbit/s flows can be handed over at the aggregated 10GE end using VLAN tags with unique VLAN ID for the outer tag, with each VLAN ID corresponding to ports 1 to 8 on the 8 x 1GE wavelength card as specified in IEEE 802.1q.

Default VLAN identifiers are 4001 to 4008 (corresponding to ports 1 to 8 on the 8 x 1GE card)

CPs can define their own VLAN IDs in the range 0002 to 4093 at time of ordering. VLAN IDs need only be unique for specific wavelength card pair, there is no restriction regarding reuse of VLAN IDs on another card in the same XG210 NTE.

The TPID value of the outer VLAN tag will need to be specified at time of ordering, allowable values are either 0x8100 (C-Tag), or 0x88a8 (S-Tag).

8.2. XG210 NTE Frame Forwarding behaviour

The XG210 NTE is capable of transporting frames conforming to IEEE 802.3 [2] with frame sizes from 64 bytes to a maximum of 2000 bytes. This is to maintain compatibility with a number of frame tagging formats, including VLAN tagging as specified in IEEE 802.1Q [4]. Other than for 10G VLAN interface variant, the service is transparent to VLAN tags and will forward VLAN tagged frames in the same way as standard (untagged) frames.

Due to the use of a 4 byte overhead for management purposes, the 10G point to point option is expected to have a reduction of throughput of up to 1% for Customer frame sizes of 400 bytes and above. For customer Ethernet frame sizes smaller than 400 bytes the throughput reduction increases to approximately 6% for 64-byte frames.

Note: The XG210 NTE will pass 9000-byte frames, however as this is not yet a recognised Ethernet standard, BT will not validate usage at this level until such time as the IEEE provide an endorsement and published standard for jumbo frames and we have tested against it.

The XG210 NTE will not be configured with IEEE 802.d [3] Bridging functionality, which allows for the Learning and Filtering of traffic packets destined for those hosts connected at the local end.

Therefore, Ethernet frames that would normally be filtered by IEEE 802.1d [3] bridging functionality are instead forwarded across the OSA XG210 link.

8.3. XG210 NTE Transparency Restrictions

All Ethernet frames are passed across the OSA link, other than the following list of known exceptions:

1. Transport of EFM OAM PDUs as defined by IEEE 802.3 [2] over OSA is not supported.
   The XG210 uses EFM OAM PDUs internally for the purposes of OAM. And as per the IEEE 802.3 [2] standards defined behaviour for EFM equipment, the end-to-end transport of customer EFM OAM PDUs over the OSA link is blocked.
2. Transport of Ethernet flow control / Pause frames over OSA is not supported.
3. Where Synchronous Ethernet and PTP (Precision Time Protocol) is enabled, IEEE 1588v2 messages (specifically PTP messages transported directly over Ethernet frames) and Synchronous Ethernet ESMC (Ethernet Synchronization Message Channel) packets will be processed, therefore transparent transport of these

packet types is not supported.

8.4. XG210 NTE Auto-Negotiation and Duplex Settings

In contrast to lower rate Ethernet signals (10, 100 and 1000Mbit/s) the 10Gbit/s Ethernet port option, in line with standards, does not support auto-negotiate to advertise speed and duplex settings. Instead, the speed is set to 10Gbit/s and the service is “Full Duplex”. Half duplex operation is not supported for any interface type on this service. For Gigabit Ethernet interface options, the customer will be required to enable auto-negotiation on their equipment. Additionally in the case of 1000BASE-T interfaces used to transport Synchronous Ethernet, CP equipment will be required to correctly set itself to either link master or link slave based on auto-negotiation messages sent by the XG210 NTE during link establishment.

8.5. XG210 NTE Link Loss Forwarding

When a break is detected on the Openreach-side of the network link, all affected customer facing ports will be forced to a link down condition. This continues until such time as the network break is repaired. Such a break may occur at the wavelength level or at the bearer level. In the event of a wavelength level break, only ports on cards transporting traffic on the affected wavelengths will shut down.

In addition, the customer may specify **User-User Link Loss Forwarding** at the time of ordering, this feature is only supported for one direction across the bearer. The exact behaviour is as follows:

a. **OSA XG210 10GE wavelength card to OSA XG210 10GE wavelength card deployments.**
   A port down condition on the 10Gbit/s port will cause the far end corresponding 10Gbit/s port to shut down, as long as the propagation direction matches the CP requirements.

b. **OSA XG210 8x1GE wavelength card to OSA XG210 8x1GE wavelength card deployments.**
   A port down condition affecting any of the ports on the 8-port card, will cause the corresponding ports of the far-end 8 port down to shut down, leaving other ports unaffected. The above assumes the direction of failure propagation, is as specified by the CP.

c. **OSA XG210 10GE VLAN (aggregated port) to OSA XG210 8x1GE wavelength card deployments**.
   A port down condition on the 10GE port will cause all 8 ports on the far-end 8x1GE wavelength card to shutdown, as long as this direction of failure propagation is as specified by the CP at order time. Note propagation of failure in the opposite direction (from any of the 8 x 1GE card ports to the 10GE aggregated port) is not supported, and cannot be specified by the CP.

A summary of the interface options for XG210 is provided in table 3 below:

Service	**ADVA Card type**	**Transparency**	**Client Port Options** Pluggable type / maximum speed / wavelength /Single-Mode(SM) or Multimode (MM) / connector type	**Client port Error signal**
10G LAN PHY	F150-ADV-XG-PM-10GE-SFP+	Ethernet Frame layer	SFP+/10G/1310S/SM/LC or SFP+/10G/850I/MM/LC	Loss of Signal
10G LAN PHY VLAN Mux	F150-ADV-XG-PM-10GE-SFP+	VLAN aware	SFP+/10G/1310S/SM/LC or SFP+/10G/850I/MM/LC	Loss of Signal
Gigabit Ethernet (optical)	F150-ADV-XG-PM-GE-8-SFP	Ethernet Frame layer	SFP/GBE/1310S/SM/LC or SFP/GBE/850I/MM/LC	Loss of Signal
Gigabit Ethernet (Electrical)	F150-ADV-XG-PM-GE-8-RJ45	Ethernet Frame layer	Not Applicable as 1000BaseT ports are built-in	Loss of Signal

Table 3: XG210 interface options

9. Synchronisation and PTP support – OSA XG210 Bearers

For the OSA XG210 bearer, Synchronous Ethernet (SyncE) with Precision Time Protocol (PTP) is an optional feature which will transport a clock source, provided by the CP, across the service to enable time and phase recovery. Both features (SyncE and PTP) are either enabled or disabled. Customers cannot select to only take one feature without the other.

All timing signals will be handled on the first wavelength card on the XG210 NTE supplied as part of the OSA XG210 bearer (first port in the case of an 8x1G card). A maximum of two ports may be used for input clock feeds (i.e. a primary and a back-up feed) per NTE. However, only a single input clock feed is supported on each wavelength card, therefore a back-up feed would require that a second wavelength card is in slot 2 on the NTE.

Only a single timing domain is supported on the XG210 NTE, with both primary (and optional back-up) timing feeds provided into the service at the same end. The synchronisation output at the far end of the service will be on all Ethernet traffic ports. The back-up feed will only be used in event of failure of the primary clock feed from the CP. The CP will be responsible for providing and maintaining the timing source.

If the optional additional XG210 chassis is added to the XG210 bearer then this can support a separate timing domain, if required, from the parent XG210. A separate licence fee will be applicable.

The BITS-In frequency port on the XG210 NTE is not supported.

The OSA XG210 bearer service supports Synchronous Ethernet as specified by ITU-T G.8261, ITU-T G.8262 and ITU-T G.8264 and Precision Time Protocol as specified by IEEE 1588v2 and ITU-T G.8275.1 Time and Phase Standard. The Openreach OSA Filter connect product is a PTP aware Telecom Boundary Clock, supporting full on Path Support (SyncE ITU-T G.8261, ITU-T G.8262, ITU-T G.8264 and PTP ITU-T G.8275.1). The Openreach service does not provide the Primary Reference Time Clock (T-GM) or traceability back to the PRTC for both Phase/Time and Frequency traceability but is only transporting Time and Phase with respect to the ITU-T G.8275.1 Telecom Profile standard.

Openreach OSA FC XG210 Phase/Sync service conforms to the Class A T-BC clock as per G.8273.2 and has a max absolute time error of 100ns. The Openreach service has 2x T-BC, therefore the Openreach service max absolute time error is 200ns. This timing performance can only be guaranteed on single fibre deployments.

It is the responsibility of the Customer to provide Time and Phase Traceability back to their PRTC in their network. Traceability Flags are used as part of the PTP messages to convey status and indicate whether the T-BC is traceable back to the PRTC, or whether traceability has been lost. If the traceability flag indicates that the PTP flow is no longer traceable back to the PRTC, then this PTP Port/Flow would no longer be considered as valid reference input to the Openreach Equipment.

The standards that the Customer needs to adhere to are as below:

- ITU-T G.8275.1
- ITU-T G.8261
- ITU-T G.8262
- ITU-T G.8264

The ITU-T G.8275.1 Time and Phase Standard defines the full on-path protocol for the delivery of Frequency and Phase/Time. It is based on point-to-point Ethernet multicast communication between adjacent nodes (IP not supported by the profile).

The customer should feed the following Phase/Sync parameters, shown in the 3 tables below, into the first Ethernet traffic port on the XG210 wavelength card. Where a secondary (back-up) timing feed Ethernet traffic port has been ordered by the customer, the Phase/Sync parameters should also be provided into the first port of the second XG210 wavelength card.

SyncE

Feature	**Openreach**	**Customer**
SyncE	Yes	Yes
ESM Channel	Yes	Yes
QL Mode	Yes	Yes

Table 4: SyncE

PTP Telecom-Boundary Clock Configuration

Feature	**Openreach**	**Customer Settings**
T-BC	Enabled	T-BC Enabled
PTP Clock Profile	G.8275.1	G.8275.1
PTP Clock Type	Boundary Clock	BC
PTP Clock Domain	24	24
Priority 1	128	128
Priority 2	128	128
Local Priority	128	128

Table 5: PTP Telecom-Boundary clock configuration

PTP Port Configuration

Feature	Openreach	Customer Setting
Master Clock Type	One Step	One Step
Local Priority	128	128
Master (Not Slave)	Configurable if Master = Enabled	Enabled
Dest. MAC ADD.	Forwardable	Forwardable
Sync Message Rate	16pps	16pps
Delay Req/Resp Message Rate	16pps	16pps
Announce Message Rate	8pps	8pps
Announce Receipt timeout	8 intervals	8 intervals
Sync Receipt Timeout	16 intervals	16 intervals
Delay Response Receipt timeout	16 intervals	16 intervals

Table 6: PTP Port configuration

A slight reduction in traffic throughput with SyncE and PTP enabled is expected. For example, where the link is used to transport 10G traffic, the maximum circuit throughput will be reduced from 9,999,986,000bps to 9,999,296,000bps, due to an additional 384kbps overhead for Sync traffic.

When G.8275.1 ITU-T T-BC is configured, 384Kbps of bandwidth is automatically allocated for the PTP Flow and all PTP Messages on all Ports that are participating in the T-BC configuration

VLAN Tags shall not be used with the Boundary Clock PTP Flow (G.8275.1 uses Multicast) – regardless of traffic tagging. The CP shall send in PTP un-tagged to the XG210 NTE.

There will be no Openreach Portal available to the customer for the OSA XG210 bearer service. Additional alarm notifications to the customer are to be confirmed, but likely to include a “PTP clock time not traceable” alarm. Holdover is expected up to 1 hour for Boundary clock. Frequency SyncE holdover may be a number of hours.

10. Optical power margins for client-side optics

The table below shows details of the Optical power margins for both the Receive and Transmit interfaces of the client facing optical interfaces. Please note that the CP may be responsible for damage caused by exceeding the optical parameters listed.

ADVA		
Customer interface type	**Valid Input Range**	**Expected Output from interface**
QSFP28/112G/LR4/SM/LC	-10.6dBm to +4.5dBm	-4.3dBm to +4.5dBm
QSFP28/112G/SR4/MM/MPO	-10.3dBm to +2.4dBm	-8.4dBm to +2.4dBm
SFP+CDR/11GU/1310S/SM/LC	-10.0dBm to -2dBm	-6.0dBm to 0dBm
SFP+CDR/10GU/850I/MM/LC	-10.0dBm to -2dBm	-8.0dBm to -1dBm
XFP/10G/850I/MM/LC	-8.0dBm to -2dBm	-8.0dBm to -1dBm
SFP+/11GU/1310S/SM/LC	-12.0dBm to -2dBm	-6.0dBm to 0dBm
SFP+/11GU/850I/MM/LC	-10.0dBm to -2dBm	-8.0dBm to -1dBm
SFP+/10G/1310S/SM/LC	-13.0dBm to -1.0dBm	-8.0dBm to -0.5dBm
XFP/11G/1310S/SM/LC	-12.0dBm to -2.0dBm	-6.0dBm to -1.0dBm
XFP/8G/1310S/SM/LC	-9.0dBm to -0.5dBm	-6.0dBm to -1.0dBm
SFP/4GU/850I/MM/LC	-13.0dBm to -1.0dBm	-10.0dBm to -2.5dBm
SFP/4GU/1310S/SM/LC	-14.0dBm to -2.0dBm	-9.0dBm to -1.0dBm
SFP/2G1/850I/MM/LC	-14.0dBm to -4.0dBm	-10.0dBm to -3.0dBm
SFP/2G5U/1310S/SM/LC	-17.0dBm to -1.0dBm	-5.0dBm to 0.0dBm
SFP+/10G/850I/MM/LC	-10.0dBm to -2dBm	-8.0dBm to -1.0dBm
SFP/GBE/1310S/SM/LC	-19.0dBm to -4.0dBm	-9.0dBm to -3.0dBm
SFP/GBE/850I/MM/LC	-15.0dBm to -1.0dBm	-10.0dBm to 0dBm

Table 7: Optical power margins

11. OSA Filter Connect network parameters

The first column in the tables below refers to port labelling on the filter card. The filters used on OSA Filter Connect use 100GHz spacing and are designed for both 50GHz and 100GHz ITU-T grid compliant optics capable of working between 192.00THz and 196.00THz.

Single fibre working (SFW) is achieved using a band filter module to multiplex the two bands over the same physical fibre. The SFW filter requires different frequencies on each end for each optical channel, for this reason this filter type may not be compatible with some CP equipment utilising coherent transceivers typically used to carry 100G/200G/400G signals.

The channel numbers indicated in the tables below relate to the channel references on the Customer Requirement Form (CRF) or other Openreach system used to place orders. The ADVA channel numbering scheme is different to the ITU-T scheme.

Note, any deviation for the centre frequency from CP equipment should be no more than +/-0.25nm from the equivalent wavelength for the centre frequency specified on a filter card, for example a deviation of +/- 0.38nm is expected to incur an additional loss of 1dB. The frequency/wavelength allocations are as follows:

11.1. Frequency plan: 4CSM (Dual Fibre Working)

Band	ADVA Channel number	A-end and B-end Port number	Centre Frequency (THz)	Equivalent Wavelength (nm)
Band 1 * D01 – D04	1	C1	196.00	1529.55
	2	C2	195.90	1530.33
	3	C3	195.80	1531.12
	4	C4	195.70	1531.90
Band 2 D05 – D08	5	C1	195.50	1533.47
	6	C2	195.40	1534.25
	7	C3	195.30	1535.04
	8	C4	195.20	1535.82
Band 3 D09 – D12	9	C1	195.00	1537.40
	10	C2	194.90	1538.19
	11	C3	194.80	1538.98
	12	C4	194.70	1539.77
Band 4 D13 – D16	13	C1	194.50	1541.35
	14	C2	194.40	1542.14
	15	C3	194.30	1542.94
	16	C4	194.20	1543.73
Band 5 D17 – D20	17	C1	193.80	1546.92
	18	C2	193.70	1547.72
	19	C3	193.60	1548.51
	20	C4	193.50	1549.32
Band 6 D21 – D24	21	C1	193.30	1550.92
	22	C2	193.20	1551.72
	23	C3	193.10	1552.52
	24	C4	193.00	1553.33
Band 7 D25 – D28	25	C1	192.80	1554.94
	26	C2	192.70	1555.75
	27	C3	192.60	1556.55
	28	C4	192.50	1557.36
Band 8 D29 – D32	29	C1	192.30	1558.98
	30	C2	192.20	1559.79
	31	C3	192.10	1560.61
	32	C4	192.00	1561.42

Table 8: 4CSM frequency plan

Notes: * Where only a single 4CSM is deployed it will use Band 1 frequencies.

Existing OSA FSP3000 (including Filter Connect) systems installed with either no optical filters (OSA Singles) or 4CSM optical filters and wavelength cards with fixed frequency network optics, that are subsequently requested to be upgraded to an 8-channel filter (8CSM or 8CSM+), may require additional equipment changes. Where a wavelength card has been deployed and the network optic frequency is not compatible with the corresponding frequencies available on the new 8CSM or 8CSM+ optical filter, that wavelength card may have to be re-tuned if available or upgraded to a new card with a frequency to match the new filter. Alternatively, an 8GSM (Group Splitter/Multiplexer) can be added to the OSA system to combine the existing 4CSM with additional 4CSM to increase the wavelength channel count to the size required. Please refer to the OSA Product Description for further information.

11.2. Frequency plan: 8CSM (Dual Fibre Working)

A-end and B-end Port number	ADVA Channel number	Centre Frequency (THz)	Equivalent Wavelength (nm)
C1	26	192.70	1555.75
C2	27	192.60	1556.55
C3	28	192.50	1557.36
C4	34	192.40	1558.17
C5	29	192.30	1558.98
C6	30	192.20	1559.79
C7	31	192.10	1560.61
C8	32	192.00	1561.42

Table 9: 8CSM frequency plan

11.3. Frequency plan: 8CSM+ (Dual Fibre Working)

A-end and B-end Port number	ADVA Channel number	Centre Frequency (THz)	Equivalent Wavelength (nm)
C1	2	195.90	1530.33
C2	3	195.80	1531.12
C3	4	195.70	1531.90
C4	33	195.60	1532.68
C5	5	195.50	1533.47
C6	6	195.40	1534.25
C7	7	195.30	1535.04
C8	8	195.20	1535.82

Table 10: 8CSM+ frequency plan

Frequency plan: 40CSM (Dual Fibre Working)

A-end and B-end Port number	ADVA Channel number	Centre Frequency (THz)	Equivalent Wavelength (nm)
C1	1	195.9	1530.33
C2	2	195.8	1531.12
C3	3	195.7	1531.9
C4	4	195.6	1532.68
C5	5	195.5	1533.47
C6	6	195.4	1534.25
C7	7	195.3	1535.04
C8	8	195.2	1535.82
C9	9	195.1	1536.61
C10	10	195.0	1537.4
C11	11	194.9	1538.19
C12	12	194.8	1538.98
C13	13	194.7	1539.77
C14	14	194.6	1540.56
C15	15	194.5	1541.35
C16	16	194.4	1542.14
C17	17	194.3	1542.94
C18	18	194.2	1543.73
C19	19	194.1	1544.53
C20	20	194.0	1545.32
C21	21	193.9	1546.12
C22	22	193.8	1546.92
C23	23	193.7	1547.72
C24	24	193.6	1548.51
C25	25	193.5	1549.32
C26	26	193.4	1550.12
C27	27	193.3	1550.92
C28	28	193.2	1551.72
C29	29	193.1	1552.52
C30	30	193.0	1553.33
C31	31	192.9	1554.13
C32	32	192.8	1554.94
C33	33	192.7	1555.75
C34	34	192.6	1556.55
C35	35	192.5	1557.36
C36	36	192.4	1558.17
C37	37	192.3	1558.98
C38	38	192.2	1559.79
C39	39	192.1	1560.61

C40	40	192.0	1561.42

Table 11: 24CSM frequency plan

The first four channels (C1 to C4) are reserved for Openreach maintenance use. Filter Connect wavelengths should start from C5.

11.4. Frequency plan: 8CSM (Single Fibre Working)

A-end / B-end as designated on filter card. A-end and B-end locations will be as defined by CP on CRF.

Channel / Client Port	A-end input			B-end input		
	ADVA Channel number	Frequency (THz)	Wavelength (nm)	ADVA Channel number	Frequency (THz)	Wavelength (nm)
C1		196.0	1529.53		195.9	1530.33
C2		195.8	1531.12		195.7	1531.9
C3		195.6	1532.68		195.5	1533.47
C4		195.4	1534.25		195.3	1535.04
C5		193.6	1548.52		193.5	1549.32
C6		193.4	1550.12		193.3	1550.92
C7		193.2	1551.72		193.1	1552.52
C8		193.0	1553.33		192.9	1554.13

Table 12: 8CSM frequency plan

Openreach managed wavelengths will use channels in the following order: U or C1, C2, C3 etc. Filter Connect wavelengths should start from C8 working towards C1.

11.5. Frequency plan: 16CSM (Single Fibre Working)

A-end / B-end as designated on filter card. A-end and B-end locations will be as defined by CP on CRF.

Channel / Client Port	A-end input			B-end input		
	ADVA Channel number	Frequency (THz)	Wavelength (nm)	ADVA Channel number	Frequency (THz)	Wavelength (nm)
C1	1	196.0	1529.55	17	193.8	1546.92
C2	2	195.9	1530.33	18	193.7	1547.72
C3	3	195.8	1531.12	19	193.6	1548.51
C4	4	195.7	1531.90	20	193.5	1549.32
C5	5	195.5	1533.47	21	193.3	1550.92

C6	6	195.4	1534.25	22	193.2	1551.72
C7	7	195.3	1535.04	23	193.1	1552.52
C8	8	195.2	1535.82	24	193.0	1553.33
C9	9	195.0	1537.40	25	192.8	1554.94
C10	10	194.9	1538.19	26	192.7	1555.75
C11	11	194.8	1538.98	27	192.6	1556.55
C12	12	194.7	1539.77	28	192.5	1557.36
C13	13	194.5	1541.35	29	192.3	1558.98
C14	14	194.4	1542.14	30	192.2	1559.79
C15	15	194.3	1542.94	31	192.1	1560.61
C16	16	194.2	1543.73	32	192.0	1561.42

Table 13: 16CSM frequency plan

The A-end 16CSM filter takes the input from the A-end Mux filter and carries 16 channels in the frequency band 196.00 - 194.20THz to the B-end.   Similarly, the B-end 16CSM filter carries 16 channels in the frequency band 193.80 - 192THz to the A-end.

11.6. Frequency plan: 24CSM (Single Fibre Working)

A-end / B-end as designated on filter card. A-end and B-end locations will be as defined by CP on CRF.

Channel / Client Port	A-end input			B-end input		
	ADVA Channel number	Frequency (THz)	Wavelength (nm)	ADVA Channel number	Frequency (THz)	Wavelength (nm)
C1		196.0	1529.53		195.9	1530.33
C2		195.8	1531.12		195.7	1531.90
C3		195.6	1532.68		195.5	1533.47
C4		195.4	1534.25		195.3	1535.04
C5		195.2	1535.82		195.1	1536.61
C6		195.0	1537.4		194.9	1538.19
C7		194.8	1538.98		194.7	1539.77
C8		194.6	1540.56		194.5	1541.35
C9		194.4	1542.14		194.3	1542.94
C10		194.2	1543.73		194.1	1544.53
C11		194.0	1545.32		193.9	1546.12
C12		193.8	1546.92		193.7	1547.72
C13		193.6	1548.52		193.5	1549.32
C14		193.4	1550.12		193.3	1550.92
C15		193.2	1551.72		193.1	1552.52
C16		193.0	1553.33		192.9	1554.13
C17		192.8	1554.94		192.7	1555.75
C18		192.6	1556.56		192.5	1557.36
C19		192.4	1558.17		192.3	1558.98
C20		192.2	1559.79		192.1	1560.61
C21		192.0	1561.42		191.9	1562.23
C22		191.8	1563.23		191.7	1563.86
C23		191.6	1564.68		191.5	1564.50
C24		191.4	1566.31		191.3	1567.13

Table 14: 24CSM frequency plan

Openreach managed wavelengths will use channels in the following order: U or C1, C2, C3 etc. Filter Connect wavelengths should start from C24 working towards C1.

11.7. Channel isolation

The channel isolation specification for each filter type is given below:

Filter type	Single Fibre/Dual Fibre Working	Adjacent isolation (dB)	Non-adjacent isolation (dB)
4CSM	DFW	30	45
4CSM+8GSM (32 channel capable)	DFW	30	45
8CSM	DFW	30	45
8CSM+	DFW	30	45
40CSM	DFW	25	25
8CSM	SFW	30	30
16CSM	SFW	30	40
24CSM	SFW	24	24

Table 15: Channel isolation

11.8. Optical safety limits

The maximum output power for any CP optical channel, shall be no more than +6dBm for any filter configuration. It will be the CPs responsibility to ensure that light levels for each optical channel do not exceed this figure.

11.9. Recommended Optical Power levels for non-amplified links

- Acceptable light level range for each channel into OSA FC filter – standard reach -1dBm to +2dBm

11.10. Recommended Optical Power levels for amplified links

For links using amplification, it will be necessary to ensure that minimum and maximum light levels are tightly controlled. Too low a light level for an optical channel will result in excessive amplifier noise affecting the optical channel, and too high a level will result in failure of the amplifier to maintain gain, in the event of more channels are added later.

A range is provided for standard links, and extended reach links. The link engineering rules assume the use of FEC (Forward Error Correction) on extended reach links, whereas on standard reach links the use of FEC is not assumed.

Acceptable light level range for each channel into OSA FC filter -1dBm to +2dBm.

11.11. Minimum OSNR tolerance for CP equipment

- Standard reach 25.6dB minimum OSNR
- Extended reach 20.1dB minimum OSNR, typically this type of equipment supports FEC

11.12. Minimum optical receiver sensitivity for CP equipment

- -22dBm as the low threshold for OSNR>30dB (0.1nm). This limit is applicable for non-amplified links
- -20dBm as the low threshold for OSNR<30dB (0.1nm). This limit is applicable for amplified links.

11.13. Worst case Chromatic Dispersion

The maximum amount of accumulated chromatic dispersion will be less than

1,101ps/nm. The worst-case chromatic dispersion value is equivalent to 64.9km of fibre based on dispersion coefficient of 16.97ps/nm.km for ITU-T G.652 single-mode fibre.

However on links that have single-ended amplification no dispersion compensation will be deployed.

11.14. Maximum Reach

Sub-10Gbit/s and 10Gbit/s only (Single Fibre Working)			
Filter type / combination reach (km)	**8 channel system (8CSM)**	**16 channel system (16CSM)**	**24 channel system (24CSM)**
Non-amplified links with standard optics	46	37	42
Pre-amp without FEC	n/a	53	n/a
Pre-amp & Booster without FEC	n/a	77	n/a
Pre-amp & Booster with FEC	n/a	n/a	n/a
Single ended amplification without FEC	n/a	53	n/a
RO1 Non-amplified links with standard optics	n/a	n/a	n/a
RO1 Pre-amp without FEC	n/a	n/a	n/a
RO1 Pre-amp & Booster without FEC	n/a	n/a	n/a
RO1 Pre-amp & Booster with FEC	n/a	n/a	n/a

Table 16: Maximum reach - Sub-10Gbit/s and 10Gbit/s only (Single Fibre Working)

Sub-10Gbit/s and 10Gbit/s only (Dual Fibre Working)			
Filter type / combination reach (km)	**4 channel system (4CSM)**	**31/32 channel system (8GSM & n x 4CSM)**	**8 channel system (8CSM/8CSM+) (upgradeable to 15/16 channels)**
Non-amplified links with standard optics	50	40	40
Pre-amp without FEC	70	64	64
Pre-amp & Booster without FEC	87	87	87
Pre-amp & Booster with FEC	103	103	101
Single ended amplification without FEC	n/a	n/a	59
RO1 Non-amplified links with standard optics	35	23	28
RO1 Pre-amp without FEC	61	56	51
RO1 Pre-amp & Booster without FEC	86	86	86
RO1 Pre-amp & Booster with FEC	103	103	101

Table 17: Maximum reach - Sub-10Gbit/s and 10Gbit/s only (Dual Fibre Working)

Mixed 10Gbit/s & 100Gbit/s coherent (Dual Fibre Working)				
Filter type / combination reach (km)	**4 channel system (4CSM)**	**31/32 channel system (8GSM & n x 4CSM)**	**8 channel system (8CSM/8CSM+) (upgradeable to 15/16 channels)**	**40 Channel System (40CSM)**

Non-amplified links with standard optics	50	40	40	28
Pre-amp without FEC	70	64	64	54
Pre-amp & Booster without FEC	78	73	80	75
Pre-amp & Booster with FEC	90	90	92	90
Single ended amplification without FEC	n/a	n/a	59	n/a
RO1 Non-amplified links with standard optics	35	23	28	n/a
RO1 Pre-amp without FEC	61	56	51	n/a
RO1 Pre-amp & Booster without FEC	76	71	81	n/a
RO1 Pre-amp & Booster with FEC	89	86	93	n/a

Table 18: Maximum reach - Mixed 10Gbit/s & 100Gbit/s coherent (Dual Fibre Working)

100Gbit/s coherent (Dual Fibre Working)					
Filter type / combination reach (km)	**Single channel system (no filter)**	**4 channel system (4CSM)**	**31/32 channel system (8GSM & n x 4CSM)**	**8 channel system (8CSM/8CSM+) (8 / 16 channels)**	**40 Channel System (40CSM)**
Non-amplified links with standard optics	65	50	40	40	40
Pre-amp without FEC	n/a	n/a	n/a	n/a	n/a
Pre-amp with FEC	n/a	70	64	64	81
Pre-amp & Booster without FEC	n/a	n/a	n/a	n/a	n/a
Pre-amp & Booster with FEC	n/a	103	103	101	102
Single ended amplification without FEC	n/a	n/a	n/a	59	n/a
Single ended amplification with FEC	n/a	n/a	n/a	n/a	n/a
RO1 Non-amplified links with standard optics	n/a	35	23	28	n/a
RO1 Pre-amp without FEC	n/a	61	56	86	n/a
RO1 Pre-amp & Booster without FEC	n/a	n/a	n/a	n/a	n/a
RO1 Pre-amp & Booster with FEC	n/a	95	94	101	n/a

Table 19: Maximum reach - 100Gbit/s coherent (Dual Fibre Working)

Notes: FEC refers to Reed Solomon encoded RS (255,239), as specified in ITU-T G.709.

11.15. Optical measurements provided on installation of Filter Connect bearers

The following optical measurements will be shared via the customer handover pack following the certification of an OSA Filter Connect bearer to enable customer network planning over the OSA infrastructure.

- Per site / bearer details to be provided to CP via Customer Handbook:
- Per channel, end-to-end loss for non-amplified bearers

- Per channel, effective gain / loss on amplified bearers
- Total fibre route distance for ITU-T G.652 and details of value of dispersion compensation on link to determine, end to end Chromatic Dispersion.

11.16. Optical interworking

It is the CPs responsibility to ensure optical signal compatibility between equipment used on either side of the OSA bearer, particularly if different equipment vendors are used at the a-end and b-end. Where alien wavelengths are deployed using coherent modulation technology, CPs are strongly advised to confirm with their system vendors that the wavelengths used are safe to use with filter connect. Some coherent modulation options are more susceptible to optical crosstalk from neighbouring (intensity-modulated) wavelengths, than others, therefore channel isolation specifications for the filters are provided in section 12.8

12. FSP3000 Transparency and Error propagation

The OSA service using FSP3000 is designed to provide as much transparency as possible. OTN and SDH overhead bytes are not modified by the service. PCS layer transparency allows not only Ethernet and Fibre Channel bytes to be transported, but also the IFG (also known as IPG) to be transported. Physical layer transparency description in *Table 3: XG210 interface options* is used to indicate that transport is at the binary level. As transport of Ethernet occurs below layer 2, (at line code/PCS level or physical layer), layer 2 Ethernet control protocols are transported transparently.

Transport of Fibre Channel frame sizes greater than 2148 bytes, and Ethernet frame sizes greater than 9600 bytes is not supported.

In the event of a failure of a client input at one end of the link, an error signal will be propagated to the far end client port. In the event of a wavelength / bearer failure, an error signal will be generated on the NTE's client port at both ends of a link. In most cases this error propagation signal will be an International Standards defined error signal for some cards, for other cards this will be a laser off/Loss of Signal condition.

It is strongly advised that interconnecting equipment with Loss of Signal error propagation behaviour is avoided as this scenario will greatly complicate the re-establishment of end-to-end connectivity.

13. Fibre

For services employing a single-mode interface, all fibre optic connections to and from the patch panel will use single-mode fibre 9/125 micron according to ITU-T G.652.

For services employing a multimode interface, all fibre optic connections to and from the patch panel will use multimode fibre 62.5/125 micron or 50/125 micron according to ITU-T G.651.

The maximum distances supported on 8G/10G multimode interfaces is dependent on the Modal Bandwidth specification of the multimode cable provided by the customer. Maximum 10G distances for various multimode cable types are provided in the table below. Distances for 8G interfaces are expected to be broadly similar.

Multimode fibre type	**Multimode cable modal bandwidth (MHz•km)**	**Operating Distance (m)**
FDDI	160	26
OM-1	200	33
OM-2	400	66
OM-3	500	82
OM-4	2000	300

Table 20: Multimode cable operating distances

14. FSP3000 NTE Power Requirements

The AC powered variants of the NTE will require two 240 Volt AC power supplies using 13 Amp switched sockets which must be provided within 1.5 metres of the NTE chassis for each chassis provided. A 240 Volt AC power supply using a 13 Amp switched socket is also required within 1.5 metres of the Openreach remote Network Management equipment.

If the customer wishes the NTE to be powered from a 48V DC supply, it is the customer's responsibility to provide and maintain this supply.

In addition to the NTE power requirements, a 50Hz AC mains supply 13amp socket should also be provided near the NTEs, to power Openreach test equipment during both initial commissioning and subsequent maintenance support activities.

15. FSP3000 NTE Cooling Requirements

The maximum power consumption figures for fully loaded FSP3000 chassis are

- 1U chassis = 240W
- 1U High Power chassis = 240W
- 1U E-temp chassis = 230W
- 7U chassis = 800W
- 9U chassis = 1200W

Where high density deployments of FSP3000 chassis are expected, the environmental cooling must be assessed to ensure that is sufficient sized for such deployments.   For this reason, it is not recommended to house more than three 7U high FSP3000 chassis, or two 9U high FSP3000 chassis, or twelve 1U high FSP3000 chassis in one cabinet, or any combination of equipment, with power consumption exceeding 2500W.

16. XG210 Power Supply

16.1. General

The information provided below relates to the XG210 NTE. Powering arrangements for optical amplification are same as for existing FSP3000 OSA bearer types as this equipment is common for both bearer types.

By placing an order with Openreach the customer has accepted the conditions placed by BT in relation to providing power, as defined below.

In relation to powering of equipment, the customer must comply with the requirements of BS7671, and the details given within the 'AC/DC Power planning and installation guide' document.

The XG210 NTE is locally powered and offers AC or DC power options. The CP will be required to provide either dual local 50Hz AC supply in the form of standard 13 Amp power socket(s); or dual -50 V DC power distributions and Earth connections, with all wiring colour schemes conforming to BS7671. It will be the customer's responsibility to ensure that the power supplies are fused and safe for Openreach to use. These should be near the NTE installation location.

A 240 Volt AC power supply using a 13 Amp switched socket is also required within 1.5 metres of the Openreach remote Network Management equipment.

16.2. Installation and Testing

In addition to the NTE powering requirements (i.e. AC or DC power as defined below), a spare 50 Hz AC mains supply 13A socket should also be provided near the NTEs' to power BT test equipment during both initial commissioning and subsequent maintenance support activities. A 50 Hz mains supply 13A socket must also be provided in close proximity to the NTE for the management router.

16.3. AC Power connection

AC power connection between Openreach equipment and the power socket will be made using a power lead fitted with a standard 13A plug. The NTE itself has dual power supply units internally and requires two AC mains supply sockets running off the same phase.

For most installations, this will require two mains connections for each NTE provided, and the consumption of the Openreach NTE in this managed service arrangement will typically be under 100 watts per NTE. An additional AC mains supply socket will be required for the management router.

16.4. DC Power Connection

The DC in-Line (Molex) connector is specified as the standard method of connecting DC power by Openreach and represents the "Demarcation Point" between Openreach and the customer. At is site the customer is required to provide suitable power and earth connection to, and be responsible for the supply, wiring and labelling to, the demarcation point. Openreach will not supply or install the DC distribution system as part of the standard Ethernet installation.

16.5. Customer-provided wiring up to the Openreach specified In-Line Connector

Wiring, MCB isolation or fuse (i.e. C type MCB or Cartridge Fuse) must be provided by the customer, up to and including the DC in-line connector, as per BT's requirements stated within the 'AC/DC Power planning and installation guide' document with respect to;

- Correctly rated MCB/Fuse ,

- Correct labelling of wiring and MCB/fuse positions compliant with BS 7671
- Correct size of cable for required voltage drop at required maximum current
- Separately fused isolatable A & B power supplies, as detailed in the 'AC/DC Power Planning and Installation Guide' document

An additional AC mains supply socket will be required for the management router. Currently the management router is AC powered only.

16.6. Additional Details

For further details on the provision of DC power see the 'AC/DC Power planning and installation guide' available on the Openreach Ethernet website. https://www.openreach.co.uk/orpg/customerzone/products/opticalservices/opticalspectrumaccess/description/osaproductdescription.do

If there is a conflict between DC power information contained in the 'AC/DC Power Planning and Installation Guide' and the SIN document, the order of precedence shall be as follows:

a) AC/DC Power Planning and Installation Guide
b) SIN

17. OSA XG210 bearer Environmental Specifications

The Temperature and humidity range of the environment used to house the XG210 NTE and associated equipment (such as amplifiers used on longer reach deployments) must not exceed the following:

- Ambient room temperature: 5°C to +40°C
- Relative humidity 5% to 85%, non-condensing

Upon request, a temperature hardened version of the XG210 NTE can be ordered for use in locations where the temperature and humidity may exceed the above limits. However, in such locations, no other OSA electronics including optical amplifiers can be deployed at those sites. This NTE is not hardened against water ingress.

Temperature hardened deployment environmental limits are the following:

- Ambient room temperature: -20°C to +60°C
- Relative humidity 5% to 95%, non-condensing

18. Applications

ESCON, FICON and Coupling Link are proprietary storage area protocols from IBM and are used in many SAN customer sites. ESCON is not supported on the FSP3000. Currently only the ISC-3 peer mode (2.125Gbit/s) variant of Coupling Link is supported on FSP3000.

19. Further Information

For enquiries concerning connection availability between sites and for further product information about this service please visit the website at www.openreach.co.uk or contact your Openreach Customer Business Manager or BT Account Manager.

If you have enquiries relating to this document, then please contact: orsinsfa@openreach.co.uk

20. References

ITU-T G.8261	Recommendation ITU-T G.8261/Y.1361 - Timing and synchronization aspects in packet networks
ITU-T G.8262	Recommendation ITU-T G.8262/Y.1362 - Timing characteristics of synchronous Ethernet equipment slave clock
ITU-T G.8264	Recommendation ITU-T G.8264/Y.1364 - Distribution of timing information through packet networks
IEEE 1588v2	IEEE standard 1588™-2008 - IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control
ITU-T G.8273.2	Recommendation ITU-T G.8273.2/Y.1368.2 - Timing characteristics of telecom boundary clocks and telecom time slave clocks
ITU-T G.8275.1	Recommendation ITU-T G.8275.1/Y.1369.1 - Precision time protocol telecom profile for phase/time synchronization with full timing support
IEEE 802.1q	IEEE Standard 802.1Q™-2014 - Bridges and Bridged Networks
BS 7671	IET Wiring Regulations 17th Edition (BS 7671:2008 incorporating amendment number 3:2015)
ITU-T G.651	Recommendation G.651 (02/98) – Characteristics of a 50/125 µm multimode graded index optical fibre cable
ITU-T G.7041	Recommendation G.7041/Y.1303 - Generic Framing Procedure (GFP)
IEEE 802.3	IEEE Standard for Information Technology -Telecommunications and information exchange between systems-Local and metropolitan area networks-Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications
ITU-T G.652	Recommendation G.652 (04/97) - Characteristics of a single-mode
Gigabit Ethernet	IEEE 802.3z or SIN 360 Gigabit Ethernet for the BT Network
Fibre Channel	ANSI/NCITS X3.288-1996 or SIN 345 Channel Extension Service 1000
2G Fibre Channel	Fibre Channel Physical interface (FC-PI), ANSI 212-642-4900 ANSI INCITS 352-2002
ESCON, FICON, FICON Express, Coupling Link, Sysplex Timers	IBM Proprietary as specified in IBM Red Book Standard for GDPS.
ITU-T G.8265.1	Recommendation ITU-T G.8265.1/Y.1365.1- Precision time protocol telecom profile for frequency synchronization

Table 21: References

Please see information available at: _ https://www.openreach.co.uk/orpg/home/helpandsupport/sins/sins.do regarding the availability of Openreach published standards.

21. Abbreviations

4CSM	4 Channel Splitter Multiplexer
8CSM	8 Channel Splitter Multiplexer
8GSM	8 Group Splitter Multiplexer
AC	Alternating Current
ANSI	American National Standards Institute
ASI	Asynchronous Serial Interface
ATM	Asynchronous Transfer Mode
CPE	Customer Premises Equipment
DC	Direct Current
DWDM	Dense Wavelength Division Multiplexing
ESCON	Enterprise Systems CONnectivity architecture [IBM]
ETR	External Time Reference
FICON	FIbre CONnectivity
Gbit/s	Gigabits per second
GDPS	Geographically Dispersed Parallel Sysplex [IBM]
IBM	International Business Machines
IFG	Inter Frame Group
IPG	Inter Packet group
IP	Internet Protocol
ISC	InterSystem Channel (Coupling Link)
ITU-T	International Telecommunication Union – Telecommunications Standardization Sector (formerly CCITT)
LAN	Local Area Network
Mbit/s	Megabits per second
MUX	Multiplexer
NCITS	National Committee for Information Technology Standards
NTE	Network Terminating Equipment
NTP	Network Terminating Point
OSA	Optical Spectrum Access
OSEA	Optical Spectrum Extended Access
OTN	Optical Transport Network" as described in ITU-T G.709 "Interfaces for the Optical Transport Network (OTN)
PCS	Physical Coding Sublayer as described in IEEE 802.3

PHY	Physical Layer
RO1	Resilience Option 1
RO2	Resilience Option 2
SAN	Storage Area Network(s)
SC	Structured Connector
SDH	Synchronous Digital Hierarchy
SIN	Suppliers' Information Note
SONET	Synchronous Optical Network
STM	Synchronous Transport Module
VSM	Versatile Switch Module
WAN	Wide Area Network

22. History

Issue	Date	Changes
Issue 1.0	4 December 2008	First issue
Issue 2.0	January 2011	Text amended to reflect withdrawal of Nortel as a OSA supplier
Issue 3.0	January 2012	Introduction of FSP3000 NTE
Issue 3.1	March 2012	Editorial changes made to section 5 in support of Issue 3.1
Issue 3.2	November 2012	Editorial changes to Table of content, update to URL in 3.1, Amendment in customer interface section 5.1 and Heat limits added in new section 7.
Issue 3.3	March 2013	Amended to advise no longer available for new supply w.e.f 1 April 2013
Issue 3.4	July 2013	Addition of ISC-3 protocol
Issue 3.5	July 2015	Change SINet site references from http://www.sinet.bt.com to http://www.btplc.com/sinet/
Issue 3.6	Mar 2017	Inclusion of Encryption service card. Inclusion of Multi-mode cable operating distances.
Issue 3.7	Dec 2017	Inclusion of 5x10 gb wavelength card 5WCA-PCN- 16GU
Issue 4	March 2018	Updated for OSA Filter Connect (available 3rd April 2018). General reformatting and section renumbering.
Issue 4.1	May 2018	Section 4.2: Removed Fast Ethernet (125Mbit/s) from list of supported services on FSP3000. Section 7, table 2: Input range for SFP+/11GU/850I/MM/LC updated to -10.0dBm to -2dBm Section 8, para 2: added "equivalent wavelength" Section 8, table 3, 4, 5, 6: Added "Channel number" column Section 8.7: removed reference to extended reach power levels Section 8.9: Minimum OSNR figures updated Section 8.10: Minimum optical receiver sensitivity figures updated Section 8.12, table 8: updated Section 8.14: new section added
4.2	June 2018	Various additions to incorporate XG210 information, including SyncE/PTP. Sections renumbered.

4.3	August 2018	Inclusion of FSP3000 High Power AC chassis: 4x 10G Core Card (4WCC-PCN-10G): 10x 10G Enterprise Card (10TCE-PCN-16G+100G): introduction of 8CSM+ filter
4.4	January 2019	Updated Section 8 to show • The 5TCE-PCN-10GU+10G card replaced the 5TCE-PCTN-10GU card for new services after October 2018. • The 5TCE-PCN-10GU+AES10G card replaced the 5TCE-PCTN-10GU+AES10G card for new services after November 2018. Updated Section 10 to clarify that the optional additional XG210 chassis can support a separate timing domain from the primary.
4.5	April 2019	Updated Section 12 to clarify that filter upgrades from 4CSM to 8CSM/8CSM+ may require additional equipment.
4.6	July 2019	Minor update to SPECIAL NOTICE for OSA FSP2000 to confirm that all services are removed. Update to Section 8 table 2 to confirm Multimode support (10GE LANPHY only) for the 2WCC-PCN-10G card. Inclusion of STM64 in table 2 for WCC-PCTN-10G card.
4.7	November 2019	Note added to Section 12 to clarify that the channel numbering scheme used in the Frequency Plan tables refer to the ADVA channel plan and is different to the ITU-T scheme.
4.8	January 2020	Minor update to Section 10 to clarify maximum absolute timing error. Rebrand to Openreach.
4.9	April 2020	Change SINet site references from http://www.btplc.com/sinet/ to https://www.openreach.co.uk/orpg/home/helpandsupport/sins/sins.do
5.0	July 2021	Updates to Sections 5, 8 and Table 2 to reflect withdrawal from new supply of 4TCA-PCN-4GU+4G, 4TCA-PCN-4GUS+4G and 5TCE-PCN-10GU+AES10G wavelength cards. Reference to FSP2000 removed from Section 2.
5.1	June 2022	Updated to show RO1 unavailable for new supply from 1 June 2022
5.2	August 2022	Addition of new filter options: 40CSM (DFW), 8CSM (SFW), 24CSM (SFW). Addition of 100WCC transponder card.

5.3	March 2023	Updates to Sections 5, 8 and Table 2 to include 9TCE wavelength card and withdrawal from new supply of 2WCC-PCN-10G, 2TWCC-PCN-2G7UB, 5TCE-PCN-10GU+10G and 2WCA-PCN-10G wavelength cards from 1 June 2023. Removal of "OSA FSP3000 Encryption Service" section.
5.4	June 2023	Update to table 19 to include maximum reach for "Single channel system (no filter)" and correction of maximum reach of unamplified 40CSM to 40km.
5.5	December 2024	Update to show certain XG210 components unavailable for new supply from 1 February 2024. Inclusion of 1U E-temp chassis (Openreach briefing ETH025/24 refers).
5.6	April 2026	Update 'Table 2 FSP3000 customer interface options' to correct OTUx transparency values.

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